

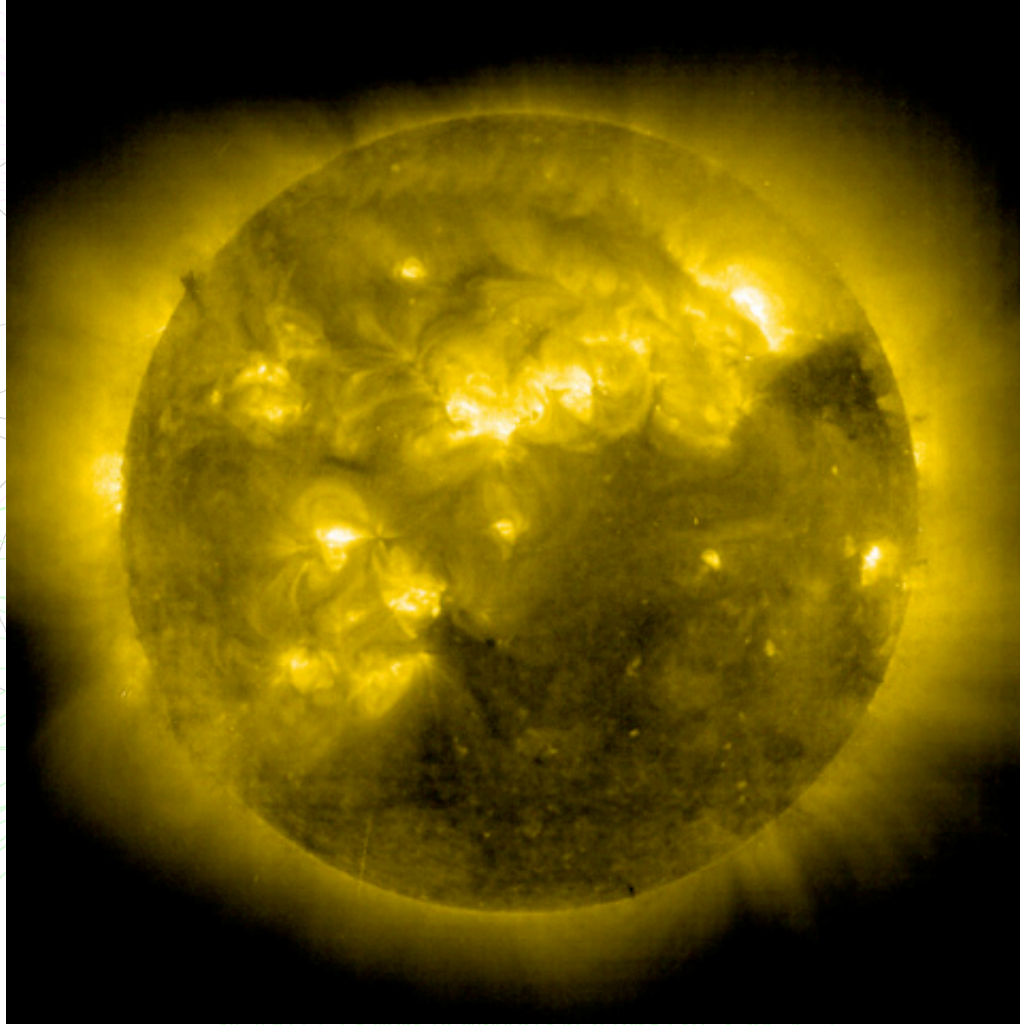


PFSS package overview

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Global magnetic fields



Features of PFSS package

- Enables the user to access a database of *potential field models of the solar corona*.
- These models are based on an *evolving surface-flux transport model* of photospheric magnetism.
- Provides software for tracing and rendering *spherically gridded vector fields*.
- Database spans entire MDI era (7/1996 onward).
- Written in IDL, distributed via SolarSoft.

What are PFSS fields?

- PFSS = *Potential Field Source Surface*
- Assumes corona is current-free:
 $\nabla \times \mathbf{B} = \mathbf{0} \Rightarrow \mathbf{B} = -\nabla\Phi$ and thus
 $\nabla^2\Phi = 0$ since $\nabla \cdot \mathbf{B} = 0$.
- Problem is to find the scalar potential Φ .
- In spherical geometry, usual solution method involves spherical harmonics.

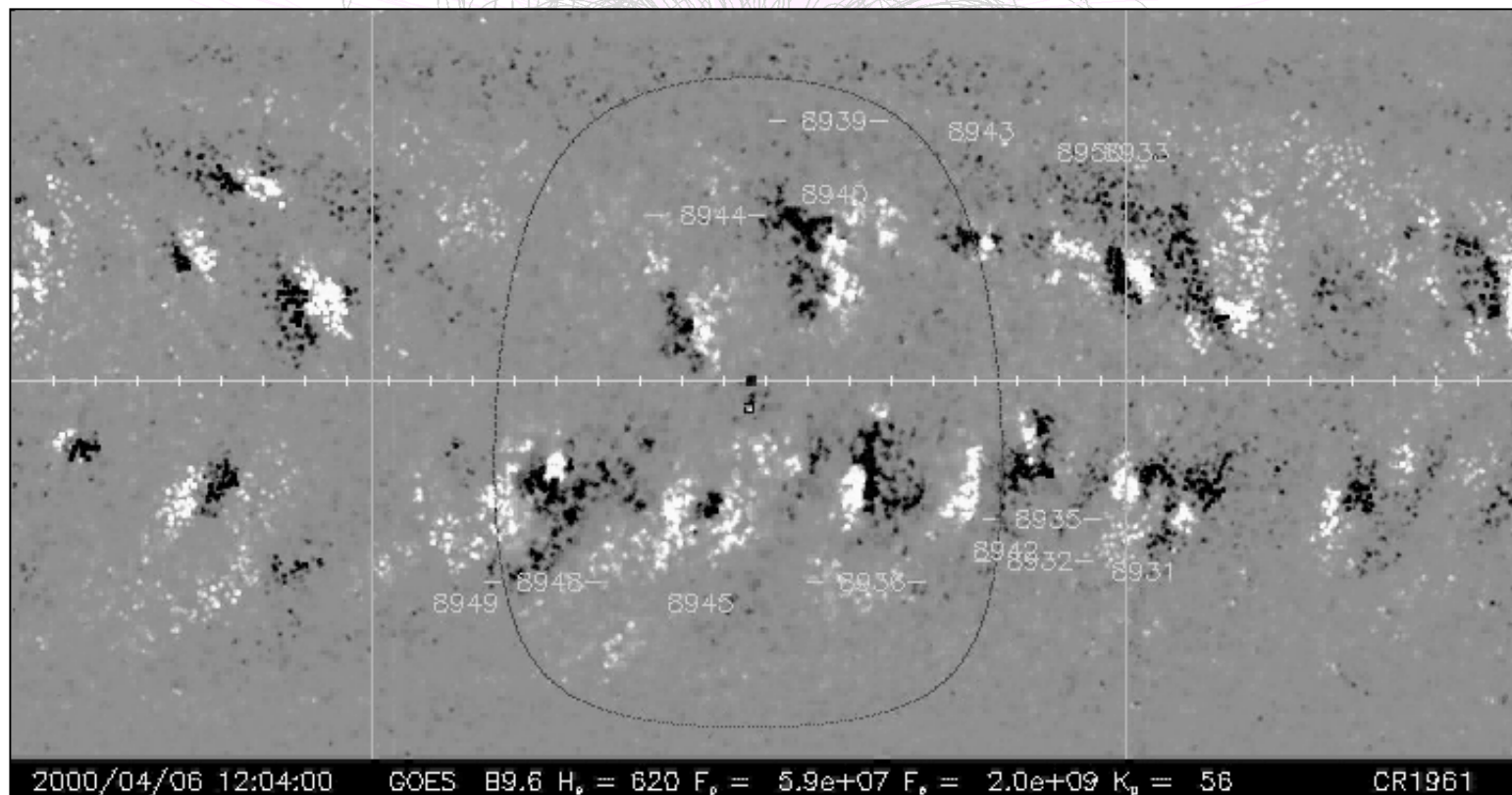
What are PFSS fields?

- Want to solve $\nabla^2\Phi = 0$ in a spherical volume between $r = 1 R_S$ and $r = 2.5 R_S$.
- Requires boundary conditions at top and bottom domain:
 - Upper BC field is assumed purely radial.
 - Lower BC field derived from our evolving surface-flux transport model (next slide).
- Solution is unique for given domain + BCs.

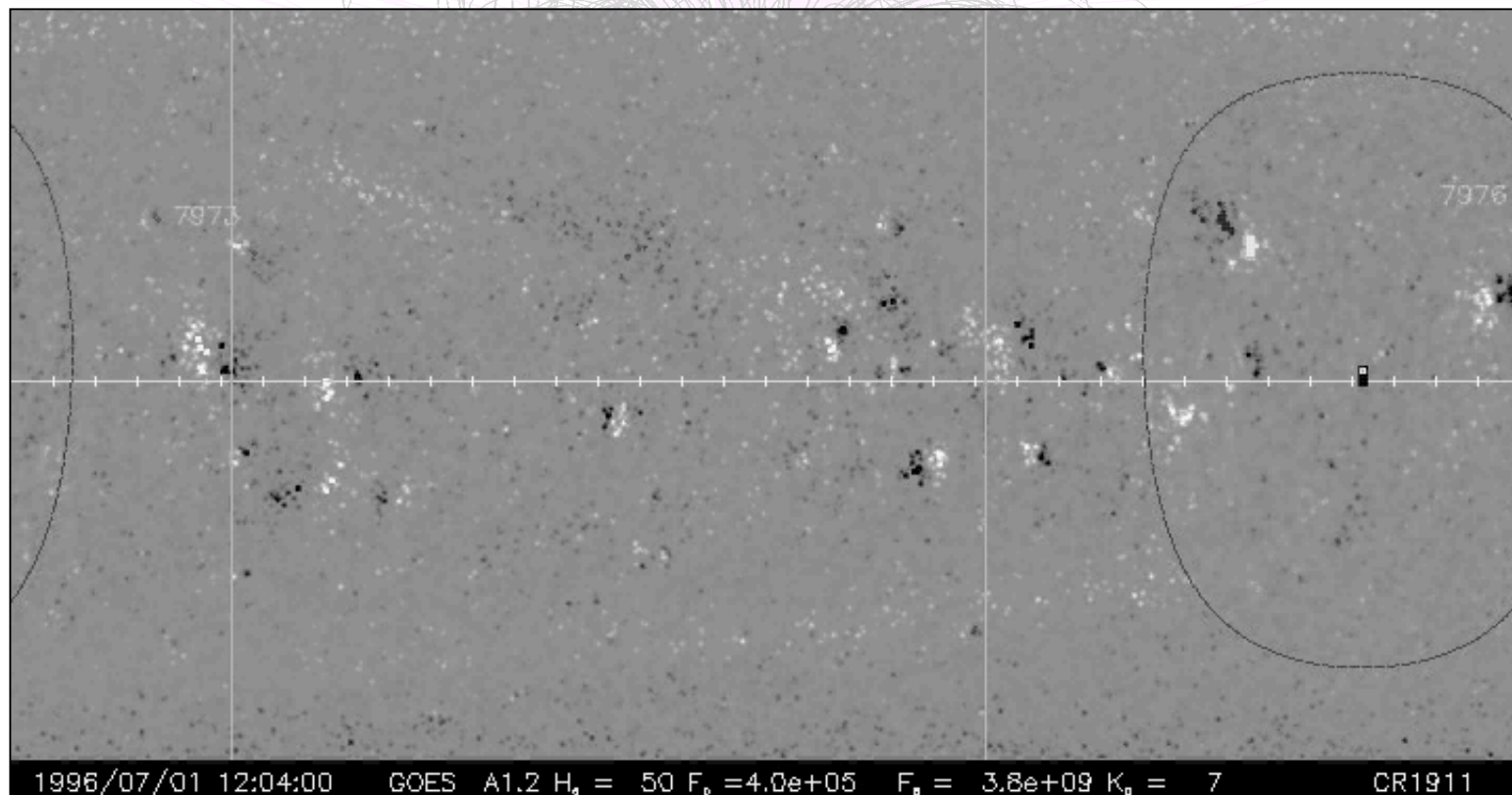
Assimilating photospheric fields

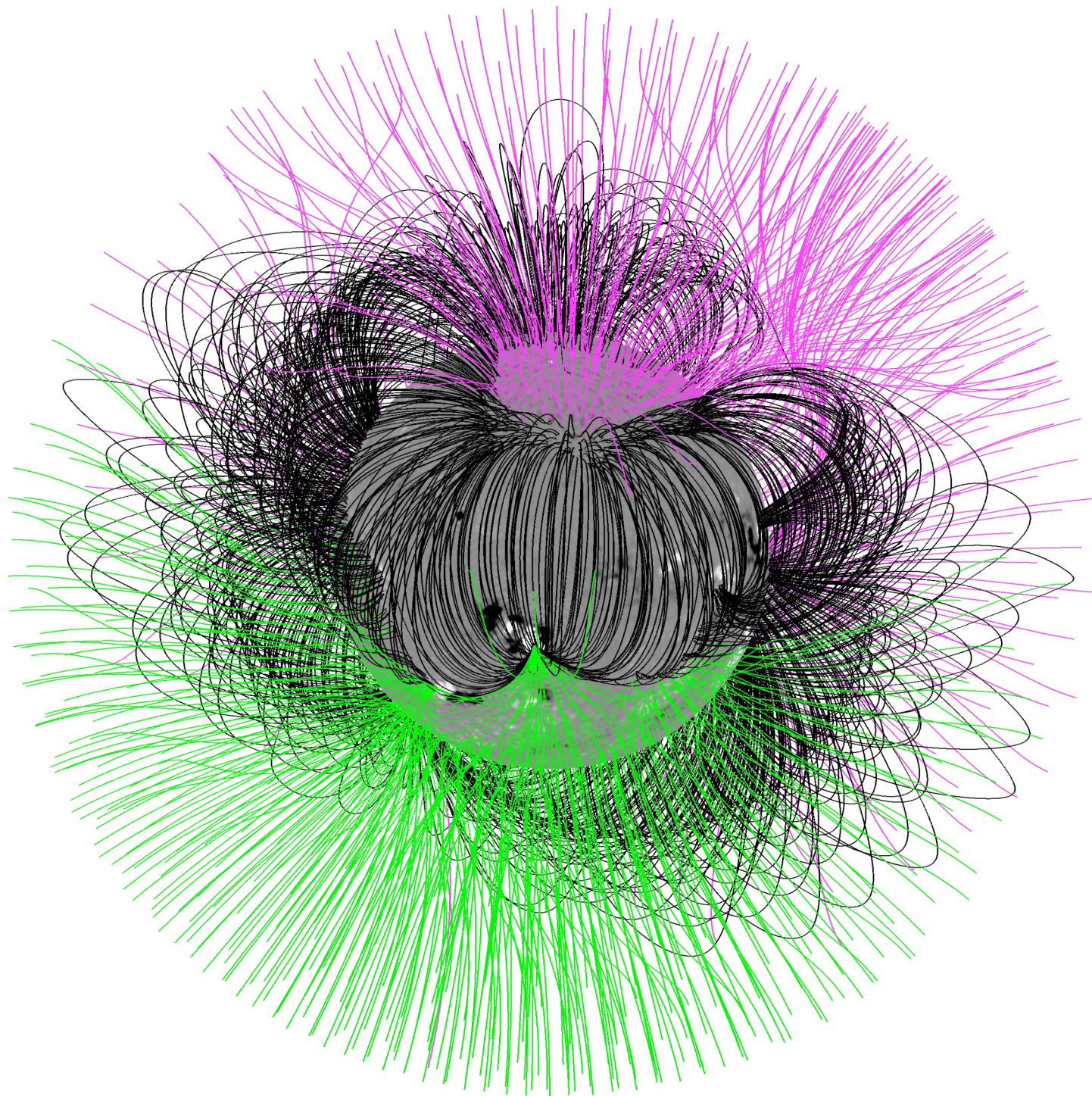
- Base model (of full photospheric surface) *advects surface flux across the surface*:
 - Empirically determined differential rotation, meridional flow, convective dispersal profiles
 - Prescription for fragmentation and collision of flux
- *MDI line-of-sight magnetograms* assimilated into model when available.

Assimilating photospheric fields



Assimilating photospheric fields






Test-driving the PFSS package

- After starting SSWIDL, load the PFSS package and start the GUI viewer by typing on the IDL command line:









```
IDL> ssw_path, /pfss
```

```
IDL> pfss_viewer
```

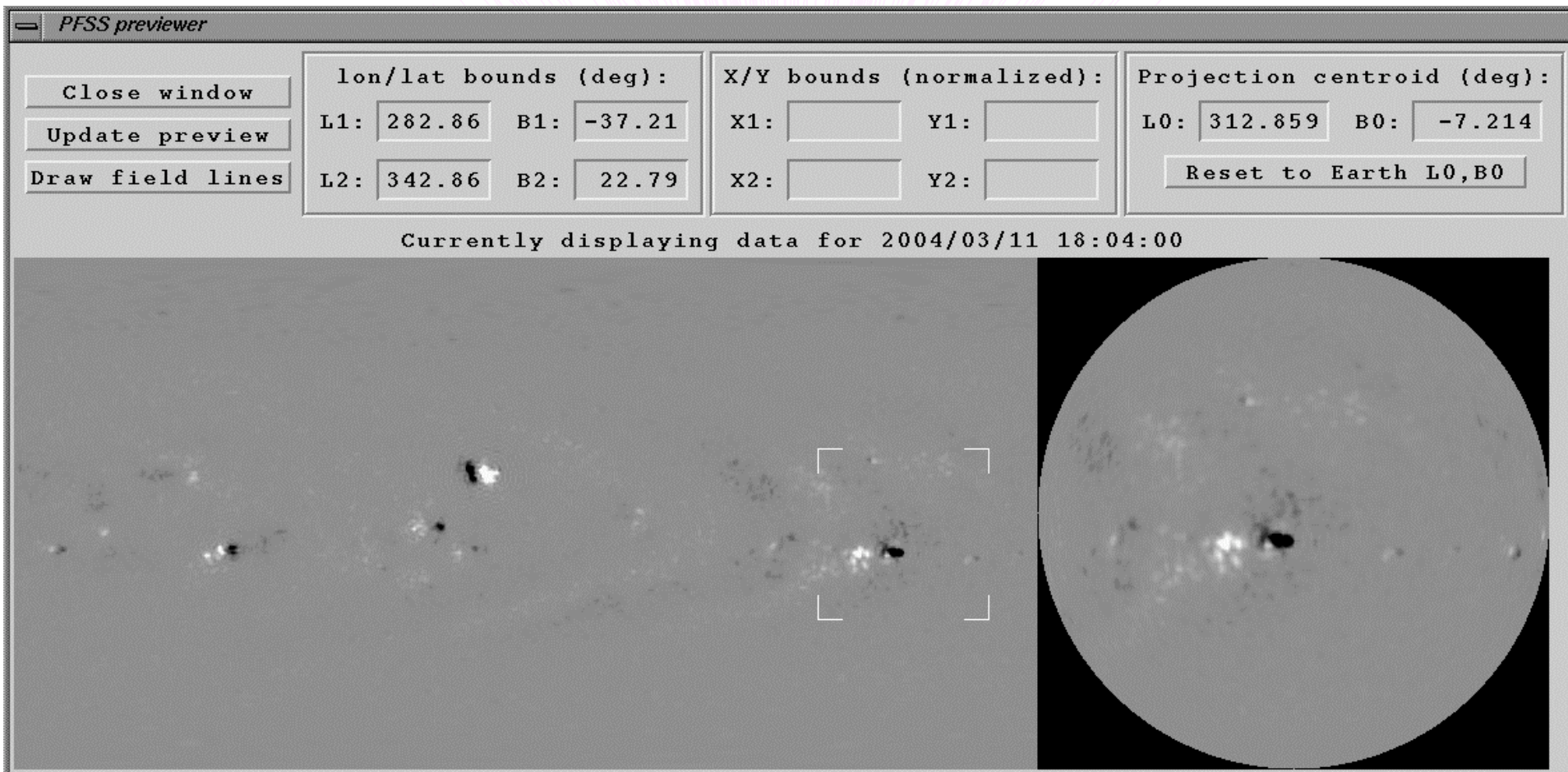
- Doing this should cause the date chooser window should open...

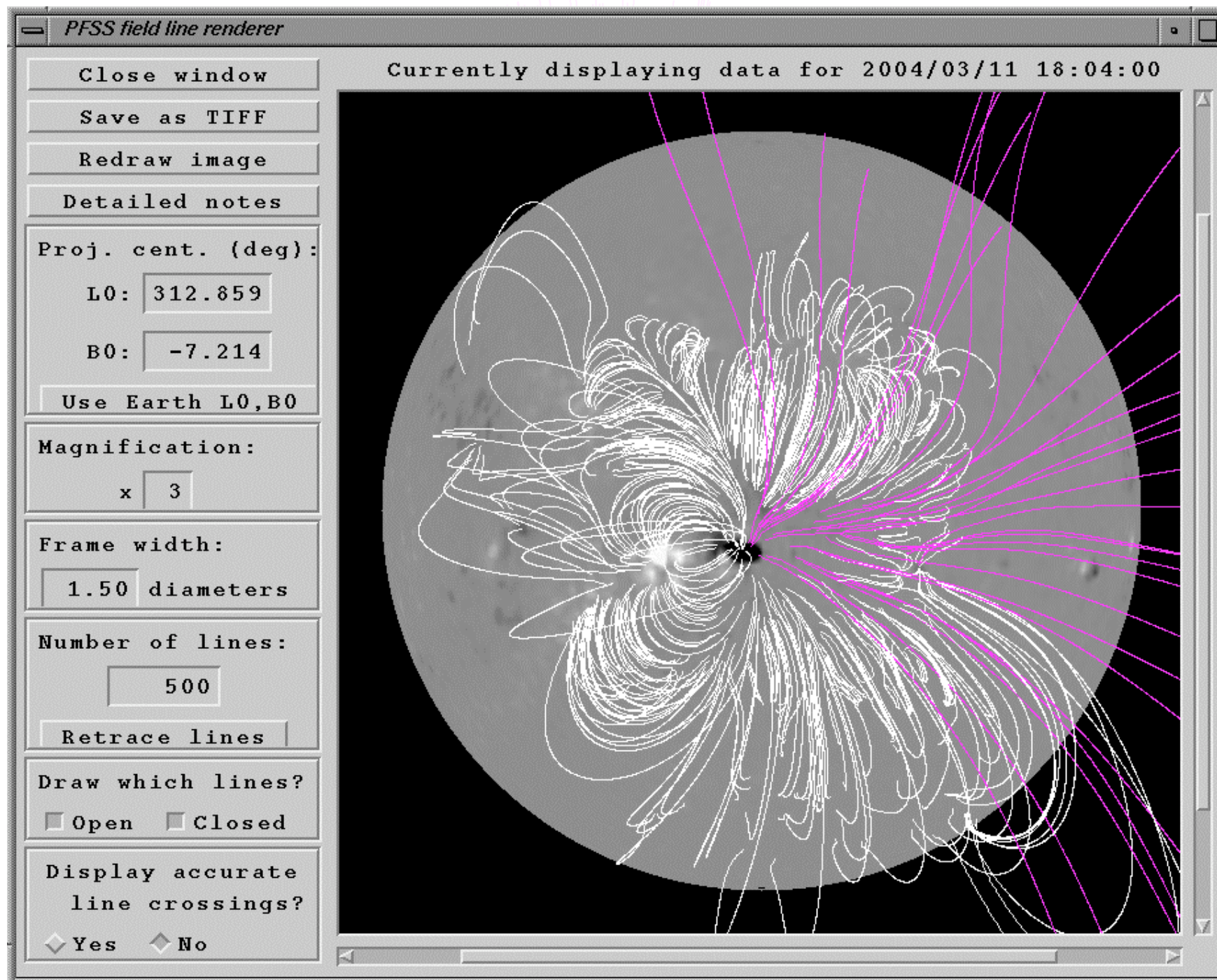
 *PFSS date chooser*

Choose date/time:

year	2000	 
	2001	
	2002	
	2003	
	2004	
month	01	 
	02	
	03	
day	07	 
	08	
	09	
	10	
	11	
time	00:04:00	 
	06:04:00	
	12:04:00	
	18:04:00	

Currently loaded:
2004-03-11 18:04:00





From the IDL command line

- Template routine is called `pfss_sample1.pro`
- Doing a `.r pfss_sample1` will load a PFSS field, trace some fieldlines, and render a hairy sun image.
- Users can specify their own fieldline starting points, as well as customize the rendering.

Documentation?

- (Some) documentation is available at <http://www.lmsal.com/~derosa/pfsspack>
- Please e-mail me at derosa@lmsal.com if questions, comments, or suggestions arise.
- References:
 - Surface-flux model:
Schrijver (2001) ApJ, 547, 475
 - Assimilation model:
Schrijver & DeRosa (2003) SPh, 212, 165